GLIA AND GLIOMATOSIS.

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Embryologists and histologists have by their recent work prepared the way for a reconsideration of the pathological features relating to the neuroglia. They have shown that the "connective tissue" of the brain—to use the term in its old signification—is an ectodermal structure, that its blastodermic precursor is the same as for the nerve cells; that it is less profoundly specialized, less highly differentiated than the nerve cells, and that it subserves a more humble purpose than these. The histologist encounters neuroglia in its several phases as it passes from its embryonic to its adult state, while the pathologist meets with it in the developed body under hardly less protean conditions. A complete knowledge of the histology and histogenesis of neuroglia must embrace all the conditions —normal and pathological—which have been observed. To the pathologist such a complete knowledge must be of the first importance, since upon it will depend his conception of the origin and the nature of a group of new growths occurring within the central nervous system.

In order that the pathological facts which I wish to bring before you may be presented in the light in which they appear to me, I shall be obliged to ask your attention to a brief account of the histogenesis of neuroglia, which, for our present purposes, can be best investigated in the spinal cord. The cells destined to become glia are derived in the embryo from the medullary plate, and are at first of the same value as the elements which eventually produce nerve cells. The possibility that cells of other values, leucocytes and endothelial cells, may, at a later period, become interpolated between the elements of ectodermal origin, and, under certain pathological conditions, act as tissue formers, while admitted by so good an authority as Ramon y Cajal, have been shown to be improbable by the researches of Schaffer and v. Lenhossék.

The glia cells—or, to use the term proposed by Fish in this country and v. Lenhossék in German, astrocytes—take their origin in the lowest and highest vertebrates from the ependyma cells, which are now known to belong to the supporting cell structures of the cord. In certain low forms (myxine, amphioxus) the ependyma cells represent the total of the supporting cells, while in the higher forms greater or less numbers of astrocytes supply the chief framework of the organ. In mammals, and especially in man, astrocytes may, it is considered by some, develop from a less highly differentiated cell than ependyma cells, which yield them exclusively in the lower forms. It is proposed to call the intermediate cells (undeveloped forms) astroblasts.

The several different forms of glia cells, those possessing long processes, those provided with short processes (typical astrocytes), and still others in which the filaments come off from one or both poles only (brush cells), as well as the true ependyma cells, have all the same ultimate origin. Since Weigert's publication in 1890, and more especially since the appearance of his monograph on neuroglia, much attention has been given to the relation existing between the fibres and the cells in neuroglia.

The pictures given by the Golgi's silver stain seem to show a close union between processes and cell bodies, and to indicate that the former are mere protoplasmic elongations of the latter. The method of staining introduced by Weigert, and more or less modified by Mallory and Beneke, would seem to necessitate a modification of these views, since by its employment differentiation between fibres and cells in adult neuroglia has been rendered possible. According to Weigert, neuroglia, in human beings, consists of cells showing protoplasmic processes only during embryonic life; in the matured or adult condition, it is made up of a mixture of cells and fibres, in which the latter so greatly predominate that they are to be regarded as its chief constituent.

If we now turn our attention to the subject of tumors developing from neuroglia, we have no difficulty in referring certain well-known types to certain forms or stages of development of neuroglia. The spider-cell or Deiter-cell glioma, in which the cell processes are protoplasmic and still attached to the cell body, and those tumors in which the brush cells predominate, agree with astrocytes in the condition in which they occur during embryonic life; while such gliomata as are richer in fibres, which by the application of the new staining methods alluded to are separable into still further differentiated fibres and independent cells devoid of processes, may be taken to represent the adult neuroglia in human beings. It is further probable that a tumor corresponding with the intermediate cell, astroblast, which it is conceived may persist in human beings as a simple undifferentiated cell, may also arise. Such a tumor would have features in common with certain tumors now regarded as small-celled sarcomata.

Recently I have come into possession, through the kindness of Drs. W. W. Keen and H. M. Thomas of a brain tumor made up of cells which resemble, for the most part, the ependymal type of cells found in the human embryonic spinal cord, and present in certain animal forms throughout the whole lifetime of the species. These cells are arranged in a radial manner around blood vessels, toward which their protoplasmic prolongations are directed. The processes come together just before the vessel wall is reached, giving rise to a minute space between them at their points of junction and the walls of the vessels. I am of the opinion that these cells probably agree with early ependymal cells, and that the tumor is to be regarded as a form of ependymal glioma. Although such a tumor has not yet certainly come to my notice, it is conceivable that the fully developed or adult ependymal cells may also give rise to tumors whose appearances would be different from the several forms already described.

The tumor formation in syringomyelia may not improbably be found to agree with one or the other of the types described. Indeed, in a case which I have seen recently the tumor mass was composed largely, if not exclusively, of cells of an early ependymal type.[1]

Finally, the tumors of the retina, which agree in so many ways with the gliomata of the brain and cord, are capable of a similar classification. There is less that is remarkable in this statement when it is remembered that the retina is histologically as well as embryologically brain substance. Tumors consisting of astrocytes (spider cells) are known to develop from the retina; simpler and less highly developed gliomata, perhaps of astroblastic origin, are more common still; while tumors composed of cells which resemble, or are identified with, the cells of the layer of rods and cones (neural epithelium), of which I described the first specimen in 1891, have now become generally recognized. The layer of rods and cones agrees histogenetically with the epithelium lining the central canal of the spinal cord and the ventricles of the brain; it is, therefore, modified ependyma. If the rods and cones are regarded in the light of their embryological origin and histological relations, then the tumors composed of them are ependymal-celled gliomata; if, however, they are regarded in the light of the physiological functions which they perform, in which they behave as neural epithelium, then these tumors may properly be denominated neuro-epitheliomata.[2]

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[1] This case occurred in the practice of Dr. Hudson, of La Fayette, Ala., who will soon publish it in detail.

[2] See Flexner, The Johns Hopkins Hospital Bulletin, 1891.